REMARKS

The Office Action dated July 22, 2004, has been received and carefully considered. Reconsideration of the outstanding rejections in the present application is respectfully requested based on the following remarks.

At the outset, Applicant notes with appreciation the indication on page 5 of the Office Action that claims 6-8 and 14-16 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. However, Applicant has opted to defer rewriting the above-identified claims in independent form pending reconsideration of the arguments presented below with respect to the rejected independent claims.

I.   THE OBVIOUSNESS REJECTION OF CLAIMS 1, 2, 9, AND 10

On pages 2-3 of the Office Action, claims 1, 2, 9, and 10 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Doerr et al. (U.S. Patent No. 6,532,090). This rejection is hereby respectfully traversed.

As stated in MPEP § 2143, to establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of

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ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). Also, as stated in MPEP § 2143.01, obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); In re Jones, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. In re Mills, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). Further, as stated in MPEP § 2143.01, to establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). That is, "[a]ll

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words in a claim must be considered in judging the patentability of that claim against the prior art." <u>In re Wilson</u>, 424 F.2d 1382, 165 USPQ 494, 496 (CCPA 1970). Additionally, as stated in MPEP § 2141.02, a prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. <u>W.L. Gore & Associates, Inc. v. Garlock, Inc.</u>, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984). Finally, if an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. <u>In re Fine</u>, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

Regarding claims 1 and 9, the Examiner asserts that Doerr et al. teaches a method for interchanging wavelengths in a multiwavelength system having W wavelength channels substantially as claimed. Specifically, the Examiner asserts that Doerr et al. teaches: selectively directing a pair of adjacent frequency channels corresponding to a respective pair of adjacent wavelength channels based upon a routing algorithm (reference numeral 910 in Figure 9); interchanging the frequencies of the selectively directed pair of adjacent frequency channels (reference numeral 930 in Figure 9); and selectively shifting the interchanged frequencies of the selectively directed pair of adjacent frequency channels

(reference numeral 206 in Figure 2 and column 4 lines 24-32, column 6 lines 20-24). However, the Examiner acknowledges that Doerr et al. fails to teach shifting of interchanged frequencies based upon a binary representation of each interchanged frequency. But the Examiner then goes on to assert that frequency shifting of frequencies based upon a binary representation of the frequency is, as noted by the applicant (page 13 lines 3-6), well known in the art and is accomplished via frequency mapping methods such as the butterfly permutation. The Examiner then goes on to further assert that frequency shift keying (FSK) is a well known digital method for assigning frequencies to specific binary representations. The Examiner then concludes that it would have been obvious to one skilled in the art at the time the invention was made to shift the interchanged frequencies based upon a binary representation of each interchanged frequency so as to arrive at the claimed invention.

First of all, Applicant respectfully submits that frequency shifting of frequencies <u>based upon binary representations of the frequencies</u> was not well known in the art at the time of the claimed invention. Applicant also respectfully objects to the Examiner's assertion that Applicant has acknowledged such. Specifically, the Examiner points to page 13, lines 3-6, of the

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present application to support the assertion that Applicant admits that frequency shifting of frequencies based upon binary representations of the frequencies is well known in the art. However, a clear contextual reading of this section of the present application will reveal that Applicant believes that connection patterns, such as shuffles or butterfly permutations, have interesting arithmetic properties that were not utilized or even known before the realization of the present invention, and that the present invention exploits such properties so as to reduce converter costs. Accordingly, it is respectfully submitted that the present application does not support a teaching that frequency shifting of frequencies based upon binary representations of the frequencies was well known in the art at the time of the claimed invention, and Applicant requests the Examiner's acknowledgement of such.

Secondly, Applicant respectfully submits that Examiner's reliance on frequency shift keying (FSK) for a teaching of frequency shifting of frequencies based upon binary representations of the frequencies is misplaced. Specifically, as one with skill in the art understands, frequency shift keying (FSK) is a digital-to-analog modulation technique, wherein data is transmitted by shifting between two frequencies with ones represented by one frequency and zeros by the other. This is

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clearly inapplicable to the claimed invention as <u>claims 1 and 9</u>

<u>both recite shifting frequencies based upon a binary</u>

<u>representation of each interchanged frequency, and not upon a</u>

<u>frequency representing binary ones or binary zeros</u>.

Accordingly, it is respectively submitted that frequency shift

keying (FSK) does not support a teaching of frequency shifting

of frequencies based upon binary representations of the

frequencies as presently claimed.

With respect to the teachings of Doerr et al., it is

respectfully submitted that, in contrast to the Examiner's

assertions, Doerr et al. does not in fact teach selectively

directing a pair of adjacent frequency channels corresponding to

a respective pair of adjacent wavelength channels based upon a

routing algorithm. Specifically, the Examiner points to the

optical add-drop multiplexers (OADMs) 910 in Figure 9 of Doerr

et al. for this teaching. However, <u>the optical add-drop</u>

<u>multiplexers (OADMs) 910 in Figure 9 of Doerr et al. are used to</u>

<u>switch multiplexed signals having multiple optical wavelengths,</u>

<u>not a pair of adjacent frequency channels corresponding to a</u>

<u>respective pair of adjacent wavelength channels, as claimed</u>.

Furthermore, <u>the OADMs 910 in Figure 9 of Doerr et al. are</u>

<u>controlled by control signals, not by a routing algorithm, as</u>

claimed. Accordingly, it is respectfully submitted that Doerr et al. fails to teach this claimed element.

Also, it is respectfully submitted that, in contrast to the Examiner's assertions, Doerr et al. does not in fact teach interchanging the frequencies of the selectively directed pair of adjacent frequency channels. Specifically, the Examiner points to the wavelength interchange (WI) 930 in Figure 9 for this teaching. However, the wavelength interchange (WI) 930 in Figure 9 of Doerr et al. are used to change the wavelength assignments of all of the optical signals in a multiplexed signal having multiple optical wavelengths, not the frequencies of the selectively directed pair of adjacent frequency channels, as claimed. Accordingly, it is respectfully submitted that Doerr et al. fails to teach this claimed element.

Furthermore, it is respectfully submitted that, in contrast to the Examiner's assertions, Doerr et al. does not in fact teach selectively shifting the interchanged frequencies of the selectively directed pair of adjacent frequency channels. Specifically, the Examiner points to the wavelength adapters (WA) 206 in Figure 2 for this teaching. However, the wavelength adapters (WA) 206 in Figure 2 of Doerr et al. are used to change the wavelength assignments of all of the optical signals in a multiplexed signal having multiple optical wavelengths, not

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selectively shift the interchanged frequencies of the selectively directed pair of adjacent frequency channels, as claimed. Accordingly, it is respectfully submitted that Doerr et al. fails to teach this claimed element.

Regarding claim 2, the Examiner asserts that Doerr et al. teaches that the claimed step of selectively directing the pair of adjacent frequency channels comprises the step of selectively switching the pair of adjacent frequency channels to one of two output pairs. However, it is respectfully submitted that, in contrast to the Examiner's assertions, Doerr et al. does not in fact teach selectively switching the pair of adjacent frequency channels to one of two output pairs. Specifically, the Examiner points to the wavelength interchange (WI) 930 in Figure 9 for this teaching. However, the wavelength interchange (WI) 930 in Figure 9 of Doerr et al. are used to change the wavelength assignments of all of the optical signals in a multiplexed signal having multiple optical wavelengths, not selectively switch the pair of adjacent frequency channels to one of two output pairs, as claimed. Accordingly, it is respectfully submitted that Doerr et al. fails to teach the elements recited in this claim.

Regarding claim 10, the Examiner asserts that Doerr et al. teaches that the claimed switching element comprises a cross-

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connect for selectively switching the pair of adjacent frequency channels to one of two output pairs. However, it is respectfully submitted that, in contrast to the Examiner's assertions, Doerr et al. does not in fact teach that the claimed switching element comprises a cross-connect for selectively switching the pair of adjacent frequency channels to one of two output pairs. Specifically, the Examiner points to the wavelength selective optical cross-connect (WSC) 204 in Figure 2 for this teaching. However, the wavelength selective optical cross-connect (WSC) 204 in Figure 2 of Doerr et al. is used to route optical wavelength channels independently from any of k inputs to any of k outputs, not selectively switch the pair of adjacent frequency channels to one of two output pairs, as claimed. Accordingly, it is respectfully submitted that Doerr et al. fails to teach the elements recited in this claim.

Furthermore, claims 2 and 10 are dependent upon independent claims 1 and 9. Thus, since independent claims 1 and 9 should be allowable as discussed above, claims 2 and 10 should also be allowable at least by virtue of their dependency on independent claims 1 and 9.

In view of the foregoing, it is respectfully requested that the aforementioned obviousness rejection of claims 1, 2, 9, and 10 be withdrawn.

II. THE OBVIOUSNESS REJECTION OF CLAIMS 3-5 AND 11-13

On pages 3-5 of the Office Action, claims 3-5 and 11-13 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Doerr et al. (U.S. Patent No. 6,532,090) in view of Lee (U.S. Patent No. 5,148,428). This rejection is hereby respectfully traversed.

Regarding claims 3, 5, 11, and 13, the Examiner acknowledges that Doerr et al. fails to teach the elements recited in all of these claims, and then generally refers to Lee as a teaching of a switching element capable of performing a binary routing algorithm based on an n-bit destination address. However, these claims do not recite routing based upon an n-bit destination address, but rather recite routing a selectively directed pair of adjacent frequency channels based upon a binary representation of the frequency of each of the selectively directed pair of adjacent frequency channels, and routing a selectively directed pair of adjacent frequency channels based upon a binary representation of each interchanged frequency. Accordingly, it is respectfully submitted that the combination of Doerr et al. and Lee fail to teach the elements recited in these claims.

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Regarding claims 4 and 12, the Examiner acknowledges that both Doerr et al. and Lee fail to teach the elements recited in these claims, but then asserts that, since Doerr et al. teaches frequency shifting in general and that shifting by frequency spacing is well known in the art, it would have been obvious to one skilled in the art at the time the invention was made to arrive at the claimed invention. However, as discussed above, Doerr et al. does not teach shifting the frequency of a pair of adjacent frequency channels. Also, Applicant respectfully submits that there is no support in the record for the conclusion that the identified features are old and well known. In accordance with MPEP § 2144.03, the Examiner must cite a reference in support of his position.

Furthermore, claims 3-5 and 11-13 are dependent upon independent claims 1 and 9. Thus, since independent claims 1 and 9 should be allowable as discussed above, claims 3-5 and 11-13 should also be allowable at least by virtue of their dependency on independent claims 1 and 9.

In view of the foregoing, it is respectfully requested that the aforementioned obviousness rejection of claims 3-5 and 11-13 be withdrawn.

III. CONCLUSION

In view of the foregoing, it is respectfully submitted that the present application is in condition for allowance, and an early indication of the same is courteously solicited. The Examiner is respectfully requested to contact the undersigned by telephone at the below listed telephone number, in order to expedite resolution of any issues and to expedite passage of the present application to issue, if any comments, questions, or suggestions arise in connection with the present application.

To the extent necessary, a petition for an extension of time under 37 CFR § 1.136 is hereby made.

Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 50-0206, and please credit any excess fees to the same deposit account.

Respectfully submitted,

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APPENDIX A

1 (Original). A method for interchanging wavelengths in a multi-wavelength system having W wavelength channels, the method comprising the steps of:

selectively directing a pair of adjacent frequency channels corresponding to a respective pair of adjacent wavelength channels based upon a routing algorithm;

interchanging the frequencies of the selectively directed pair of adjacent frequency channels; and

selectively shifting the interchanged frequencies of the selectively directed pair of adjacent frequency channels based upon a binary representation of each interchanged frequency.

2 (Original). The method as defined in claim 1, wherein the step of selectively directing the pair of adjacent frequency channels comprises the step of:

selectively switching the pair of adjacent frequency channels to one of two output pairs.

3 (Original). The method as defined in claim 1, wherein the step of interchanging the frequencies of the selectively directed pair of adjacent frequency channels comprises the step of:

routing the selectively directed pair of adjacent frequency channels based upon a binary representation of the frequency of each of the selectively directed pair of adjacent frequency channels.

4 (Original). The method as defined in claim 3, wherein the step of interchanging the frequencies of the selectively directed pair of adjacent frequency channels further comprises the steps of:

shifting the frequency of a first of the selectively directed pair of adjacent frequency channels by an amount defined by $+\Delta f$; and

shifting the frequency of a second of the selectively directed pair of adjacent frequency channels by an amount defined by $-\Delta f$;

wherein Δf is the frequency spacing between the pair of adjacent frequency channels.

5 (Original). The method as defined in claim 1, wherein the step of selectively shifting the interchanged frequencies of the selectively directed pair of adjacent frequency channels comprises the step of:

routing the selectively directed pair of adjacent frequency

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channels based upon the binary representation of each interchanged frequency.

6 (Original). The method as defined in claim 5, wherein the step of selectively shifting the interchanged frequencies of the selectively directed pair of adjacent frequency channels further comprises the step of:

shifting the frequency of at least one of the selectively directed pair of adjacent frequency channels by an amount defined by $\pm(2^h-1)\Delta f$, wherein $h=0,...,w-1$, $w=\log_2 W$, and Δf is the frequency spacing between the pair of adjacent frequency channels.

7 (Original). The method as defined in claim 5, wherein the step of selectively shifting the interchanged frequencies of the selectively directed pair of adjacent frequency channels further comprises the steps of:

shifting the frequency of at least one of the selectively directed pair of adjacent frequency channels by an amount defined by $-2^h\Delta f$;

increasing the shifted frequency of the at least one of the selectively directed pair of adjacent frequency channels; and

shifting the increased shifted frequency of the at least one of

the selectively directed pair of adjacent frequency channels by

an amount defined by $+\Delta f$;

wherein $h = 0,...,w-1$, $w = \log_2 W$, and Δf is the frequency spacing

between the pair of adjacent frequency channels.

8 (Original). The method as defined in claim 5, wherein the

step of selectively shifting the interchanged frequencies of the

selectively directed pair of adjacent frequency channels further

comprises the steps of:

shifting the frequency of at least one of the selectively

directed pair of adjacent frequency channels by an amount

defined by $-\Delta f$;

decreasing the shifted frequency of the at least one of the

selectively directed pair of adjacent frequency channels; and

shifting the decreased shifted frequency of the at least one of

the selectively directed pair of adjacent frequency channels by

an amount defined by $+2^h \Delta f$;

wherein $h = 0,...,w-1$, $w = \log_2 W$, and Δf is the frequency spacing

between the pair of adjacent frequency channels.

9 (Original). An apparatus for interchanging wavelengths in a

multi-wavelength system having W wavelength channels, the

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apparatus comprising:

a switching element for selectively directing a pair of adjacent frequency channels corresponding to a respective pair of adjacent wavelength channels based upon a routing algorithm;

a state changer for interchanging the frequencies of the selectively directed pair of adjacent frequency channels; and

a connection module for selectively shifting the interchanged frequencies of the selectively directed pair of adjacent frequency channels based upon a binary representation of each interchanged frequency.

10 (Original). The apparatus as defined in claim 9, the switching element comprises:

a cross-connect for selectively switching the pair of adjacent frequency channels to one of two output pairs.

11 (Original). The apparatus as defined in claim 9, wherein the state changer comprises:

a router for routing the selectively directed pair of adjacent frequency channels based upon a binary representation of the frequency of each of the selectively directed pair of adjacent frequency channels.

12 (Original). The apparatus as defined in claim 11, wherein the state changer further comprises:

a first frequency shifter for shifting the frequency of a first of the selectively directed pair of adjacent frequency channels by an amount defined by $+\Delta f$; and

a second frequency shifter for shifting the frequency of a second of the selectively directed pair of adjacent frequency channels by an amount defined by $-\Delta f$;

wherein Δf is the frequency spacing between the pair of adjacent frequency channels.

13 (Original). The apparatus as defined in claim 9, wherein the connection module comprises:

a router for routing the selectively directed pair of adjacent frequency channels based upon the binary representation of each interchanged frequency.

14 (Original). The apparatus as defined in claim 13, wherein the connection module further comprises:

at least one frequency shifter for shifting the frequency of at least one of the selectively directed pair of adjacent frequency channels by an amount defined by $\pm(2^h-1)\Delta f$, wherein $h=0,...,w-1$, $w=\log_2 W$, and Δf is the frequency spacing between the

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pair of adjacent frequency channels.

15 (Original). The apparatus as defined in claim 13, wherein the connection module further comprises:

a first frequency shifter for shifting the frequency of at least one of the selectively directed pair of adjacent frequency channels by an amount defined by $-2^h \Delta f$;

an increasing up-converter for increasing the shifted frequency of the at least one of the selectively directed pair of adjacent frequency channels; and

a second frequency shifter for shifting the increased shifted frequency of the at least one of the selectively directed pair of adjacent frequency channels by an amount defined by $+\Delta f$;

wherein $h = 0,...,w-1$, $w = \log_2 W$, and Δf is the frequency spacing between the pair of adjacent frequency channels.

16 (Original). The apparatus as defined in claim 13, wherein the connection module further comprises:

a first frequency shifter for shifting the frequency of at least one of the selectively directed pair of adjacent frequency channels by an amount defined by $-\Delta f$;

an increasing down-converter for decreasing the shifted

frequency of the at least one of the selectively directed pair of adjacent frequency channels; and

a second frequency shifter for shifting the decreased shifted frequency of the at least one of the selectively directed pair of adjacent frequency channels by an amount defined by $+2^h\Delta f$;

wherein $h=0,...,w-1$, $w=\log_2 W$, and Δf is the frequency spacing between the pair of adjacent frequency channels.